SYMONS'S

METEOROLOGICAL MAGAZINE.

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LAND MARKS IN OUR HISTORY.

THE end of the nineteenth century, and the close of the Victorian era which has been coincident with the greater and more progressive part of it, dwarf all the other milestones of contemporary history. The death of the Queen, after a reign unexampled for length and prosperity, has plunged the nation and the empire into a mourning without parallel.

During the nineteenth century all the physical sciences have been born again with new powers and fresh equipment, and the Victorian era has witnessed their growth into maturity. Of the direct influence on the progress of science of the tranquil reign of the best and most justly beloved of British monarchs, much can be said, but this is not the place to say it. We may recall, as a pleasant thought for the meteorologist, that our finest days have acquired, and will probably retain in popular speech, the happy synonym of "Queen's Weather."

In the lecture, which the late Mr. Symons delivered to the Royal Meteorological Society, on the occasion of the Diamond Jubilee, in 1897, he called attention to the striking contrast between the instrumental equipment of the student of weather in the first, and in the sixtieth year of the Queen's reign. He went further, and compiled a curious document, a "British Rainfall" for 1837, comprising the 161 complete records of rainfall, which were all that could be discovered as having been recorded in that year.* By his own unwearied exertions, Mr. Symons was able to enlist the co-operation of an army of volunteer workers, and to gather in from the more educated public of 1898, nearly 3,500 complete records.

In commencing the thirty-sixth volume of this magazine, we are painfully aware that for it also an era has ended. Some change must mark every new departure, but here we trust that it will be a change of manner only, not of aim.

There are fortunately precedents for retaining the name of the founder of a scientific journal in its title after his guiding hand has been removed by death. "Silliman's Journal" had a long and

* *Quart. Journ. Roy. Met. Soc.*, **23** (1897), 207-210.

honoured career in America, and the memory of the late eminent geographer, Dr. A. Petermann, is enshrined in the famous German geographical monthly known as "Petermanns Mitteilungen." But, if no precedent had existed, we should in this case have created one, for the individuality of the founder so permeated the first thirty-four volumes of the magazine, that the name of Symons has acquired a right to remain in the title for ever, as a memorial of the first editor, and an incentive and example to his successors.

We shall strive to follow the guiding principle which Mr. Symons set before him, to make the magazine "a full chronicle of the progress of meteorology," and while the magazine will be, as heretofore, a medium for communication with the observers of the Rainfall Organization, we hope to be able to touch upon all aspects of the latest meteorological work, and to secure the co-operation of leading meteorologists in all countries.

With very limited space, which we hope an advance in the circulation of the magazine may ultimately enable us to increase, it is necessary to study conciseness before every other literary grace. We trust that it may be possible, in the future, as it has been in the past, to combine brevity of expression with accuracy of statement.

We are happy to feel that in conducting the British Rainfall Organization jointly, the invaluable experience of Mr. Sowerby Wallis will be available to advise us in the task of Editorship, of which we have relieved him, and in the execution of which we confidently hope for help from the suggestions and criticisms of our readers.

THE PRESSURE OF THE WIND.

By R. H. Curtis.

In some recent numbers of this magazine* the question of the maximum strength of the wind was discussed, and in order to facilitate the comparison of the force observed at various places the *velocity* of the wind, so far as anemometrical measurements of that element were available, was quoted. For many purposes, however, it is more useful to know the *pressure* the wind exerts, than the rate at which it moves; and whenever velocity only is recorded by the anemometer it is certainly desirable to be able to determine the equivalent pressures. A knowledge of the rate at which masses of air move across the Earth's surface is, of course, most important in discussing questions connected with the general circulation of the atmosphere; but meteorology has another, and, perhaps, more obviously practical purpose, which is to utilize the observations made by its innumerable observers in throwing light upon allied ques-

* *Symons's Met. Mag.*, **35** (1900) 49-54, 65-66.

tions, whose solution may be a matter of considerable concern to many who are not meteorologists; and when the answer happens to involve a knowledge of the strength of the wind, it is, as a rule, its pressure rather than its velocity which is required.

For example: the engineer is concerned with the safety of his structures, and the ship designer, or the sailor, with the stability of his vessels, and each requires to know the maximum wind-*pressure* per unit of surface which he may expect, and for which he must provide in his designs. For this information they turn to the meteorologist, whose business it is to observe, more or less continuously, this very phenomenon amongst others, and who might therefore reasonably enough be expected to have the required data ready to hand. Unfortunately, the confession has to be made that, in the instances specified, the engineer would not get the reliable answer which he needs, owing largely to the fact that hitherto meteorologists have given far too little attention to observations in this particular branch of their science. Yet few questions could be of more immediate practical importance, for the correctness, or otherwise, of the answer to it, may involve the saving or waste of large sums of money, or the safety of innumerable lives.

A good deal of attention was directed to the subject of wind-pressure in 1880, after the collapse of the Tay Bridge while a train was crossing it, during a gale on the evening of December 28th, 1879. One direct result of that catastrophe was the appointment of a committee to "consider the question of wind-force on railway structures." This committee got together statements as to the maximum wind-pressure and velocity which had been observed at various places at home and abroad, and arrived at the conclusion that the maximum pressure, which was likely to be experienced over a large surface, was 56 lbs. per square foot; but that, to ensure safety, bridges and similar structures ought to be built to withstand pressures of *four* times that amount. That this estimated pressure of 56 lbs. was greatly in excess of anything ever likely to be experienced in any part of this country is now tolerably certain; and although it is, no doubt, well to err in such matters on the safe side, yet there is a limit beyond which it becomes useless to extend the margin of safety, and it is more than useless to do so when it also means an extravagant expenditure of public money.

It has been stated, for example, that if the engineer who designed the Tower Bridge had not been obliged to provide for a wind-pressure, which is practically certain never to be approached in the position where the bridge stands, its cost would have been much lower, whilst the structure would still have been left with a very ample margin of safety.

Sir J. Wolfe Barry, the engineer of the bridge, said, at the Institution of Civil Engineers, "He had appreciated at the time that such a pressure (56 lbs. per square foot) was excessive —that no such pressure was produced by wind on large surfaces

in this country—that it never had been, and that it never could be, realised . . . . But we were blessed—or otherwise—with a Board of Trade, which had laid it down, on what he thought must have been insufficient premises, that all structures must be adequate to resist a wind-pressure of 56 lbs. per square foot. . . . . The result no doubt was that much more money had been spent than was really required."*

Against this statement it will no doubt be asked, have not wind-pressures much greater than 56 lbs. per square foot been registered by anemometers in the British Isles, and if so, may they not occur again? And the somewhat paradoxical answer is that such pressures have certainly been recorded, but that it is almost equally certain they did not really occur.

The simple fact is that, from various causes, a great amount of misconception has arisen upon the subject, not a little of which has been directly due to faults inherent in the form of pressure anemometer, which has been most generally used in England during the last half-century, and which has been responsible for these very remarkable records.

The earliest anemometer, of which we have any account, was the pressure-plate instrument described by Hook, in the first volume of the *Philosophical Transactions*, in which a swinging board, being "exposed to the wind, so that the flat side may be right up against it, the number of degrees . . . . to which the wind blows up or raises that flat side, shows the force or strength of the wind, in proportion to the resistance of the flat side of the instrument."

Since 1667, when this description was published, all kinds of contrivances have been introduced to "show the force or strength of the wind," some of which have been designed to automatically register their indications. Most of them have, however, for one reason or another, been very little used; but one which was designed by Mr. Osler, of Birmingham, in 1836, is an exception to this rule, and has been employed at many observatories in this country and abroad, and is still in use at Greenwich, Bidston and elsewhere. This instrument, which is known as "Osler's pressure-plate," may be briefly described as a plate which is kept facing the wind, by whose force it is driven against some springs placed behind it, the resistance of which affords a measure of the wind's strength.

In a severe gale, which occurred on March 9th, 1871, the anemometer of this type in use at the observatory on Bidston Hill, near Liverpool, registered the extraordinary pressure of 90 lbs. per square foot; and on other occasions pressures of 80 lbs. 70 lbs., and 65 lbs. have also been recorded at the same place.

Referring to these exceptional records, the committee on wind-force just mentioned, remark in their report: "We are satisfied that these records are not referable to instrumental error, depending

* "Proc. Inst. Civil Engineers," **127**, p. 78.

on the recording instrument being carried by its momentum beyond the position of equilibrium under the wind pressure acting at the moment, but represent a real phenomenon."

Coming from such an authority, this statement is of course entitled to careful consideration; but one cannot resist the conviction that those who made it were not fully aware of, or did not realise, the exact conditions under which this anemometer works.

Its scale was graduated under steadily augmented pressures, in which the inertia of the plate could have no effect; but in a gale of wind the plate is subject to a very different kind of action, namely, a succession of impulses, sharply applied and quickly succeeding each other, under the influence of which it is certain, from theoretical considerations alone, that it must oscillate in such a way as to yield a greatly exaggerated record, although it may not be possible to say exactly what the maximum limit of the error which might be produced would be. But this fact at once throws a doubt upon the high records we have quoted, and the doubt is strengthened by other considerations.

There are in this country many very exposed structures, standing high above the ground, in places where they experience the full force of the wind; and, although a wind-pressure of much less than 60 lbs. per square foot would suffice to topple them over, yet they have successfully withstood those very gales in which even higher pressures than 60 lbs. have been recorded. Indeed, it is fairly certain that a wind-force of less than 60 lbs. per square foot, to say nothing of a force 50 per cent. greater, would have sufficed to carry away the Bidston anemometer itself.

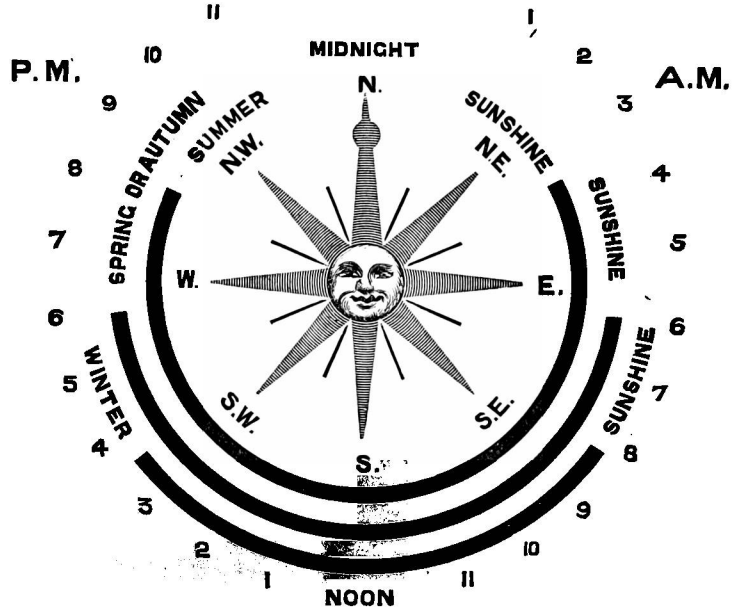
To be continued.

WEATHER RECORDS AT SLOUGH.

THE importance of preserving old registers of weather has frequently been insisted on in these pages, and this can best be done by the personal researches of meteorological observers, each in his own locality. An excellent example of such a collection in the making is before us in the form of "Meteorological Notes applying to South Buckinghamshire," compiled and privately printed by Mr. Richard Bentley, of Upton, Slough. These notes comprise a number of interesting facts about the weather of Slough and its immediate neighbourhood. Instrumental observations at Slough began in the later part of the eighteenth century, when Sir William Herschel established his observatory there, while for non-instrumental observations, old writings yield a store of droughts, floods, snow-

storms and frosts, reaching back, if the printer has not played a trick with us, to the year 9 A.D., in one instance. When, referring to very early statements, however briefly, we think it would be well to cite the authority in every case, so that mere rumours, repeated many years after the alleged event, may not be confused with contemporary records by responsible chroniclers.

A classification of the rainfall of the period 1874-1899 is given in the form of two tables, one giving the falls for each summer half-year, April 1st to September 30th, the other for each winter half-year, October 1st to March 31st. On averaging the figures, we find practical equality between the two half-years, 12·35 in. as the average of 25 summer half-years, and 12·52 in. as the average of 26 winter half-years, the latter figure for 25 half-years being reduced



to 12·51, if the last half-year of the series is omitted, or increased to 12·70 if the first half-year of the series is omitted. The maxima and minima are, for the summer half-year, 25·16 in. and 4·64 in.; for the winter half-year, 19·10 in. and 5·48 in., the summer rains being the more variable.

We are indebted to Mr. Bentley for the opportunity of reproducing the accompanying diagram, which shows graphically the number of hours of possible sunshine, and the hours and compass bearing of sunrise and sunset at the solstices and equinoxes for the latitude of Slough, 51° 30′ N., which is also the latitude of the south of London.

Mr. Bentley will be glad to receive any additional early notices of weather, floods, earthquakes, or other recurrent phenomena, in the neighbourhood of Slough.

THE HEAVY RAINFALL OF DECEMBER 30TH, 1900.

To the Editor of Symons's Meteorological Magazine.

A weather chart drawn at, say, 12 o'clock noon, on December 30th, would, I think, have been interesting. The depression over the north-west of Ireland, shown by the 8 a.m. chart of that day, seems to have dispersed or been swallowed up in the far more intense system which moved during the day up the English Channel.

The Daily Weather Report of the Meteorological Office, for the 31st December (8 a.m.), states that the former system moved eastwards to the north of England (there is little trace of it in the 6 p.m. chart of the 30th), and that the latter system was a secondary. The former depression apparently did not move S.E. wards over the S.W. and S. counties of England. I think the point is of interest, as there is nothing in the shifts of wind, as recorded in London, to show that this was not the case, and one would suppose, from a first inspection of the charts of the 30th December, that it was so.

The heavy rain was caused by the secondary, which moved up the channel and thence south-eastwards past Dieppe.

F. DRUCE.

65, *Cadogan Square, S. W., February 3rd*, 1901.

[The fact that the centre of the cyclone in the 6 p.m. chart of December 30th (*Times*, December 31st), is represented on the middle of the south coast of England, in a position intermediate between those of the centres at 8 a.m. on the 30th and 31st, misled us, and we can see no indication in the isobars that the very deep depression was a secondary. A chart for noon on the 30th would certainly have been very interesting in showing the movements of the depressions. The note in the text of the Weather Report escaped our attention, and we are grateful for this correction, for two reasons: first, because it corrects an error, and, second, because it shows how vigilant our readers are.—ED. *S.M.M.*]

THE SEVERE FROST OF JANUARY 8TH & 9TH.

A SUDDEN, short, but very severe, fall of temperature was experienced in the south of England on the night between January 8th and 9th, and many readings under 15° are recorded.

Miss Pasley writes:—

At Botley Hill, January 8th was a day of constant heavy snow-showers, the snow lying eventually about 2 inches deep, there was no wind, and it was only just freezing. It cleared up towards evening, and the temperature fell very fast; a thermometer on the

house-wall outside a window showed 14° at 10 p.m., and had 11° as its minimum. Two thermometers in the garden, hung against posts, about eighteen inches from the ground, registered 5°, and two others, exposed to the sky, about two feet above the ground, gave minimum readings of 2° and 3°. At Botley Rectory the garden thermometer showed 2°, while in another garden a reading of 0° is reported. The thermometers were not verified and had no Kew certificates. The frost was so intense, that the footprints of a man across a lawn appeared as burnt brown patches, when the snow, which had protected the rest of the grass, disappeared. The gardeners all say that the temperature began to rise before 11.30 p.m., so that the period of extreme cold must have been very short indeed. At 7.30 a.m., on the 9th, the thermometer was at 30°.

Colonel Johnston, R.E., Director of the Ordnance Survey, kindly informs us that the certified thermometers at the Ordnance Survey Office in Southampton (about 5 miles from Botley Hill), showed minima of 13°·1 in a screen, and 11°·1 on the grass; and it will be observed in our monthly table, that 5° in the shade (and 2° on the grass) was registered at Hartley Wintney, 20 miles north-east of Botley; and at Alderbury, 20 miles to the northwest, the minimum was 11°.

Mr. E. L. M. Colvile, of Kempsey, Bournemouth, writes:—

The frost of the night of January 8th-9th was very severe here, a minimum of 15°·2 being recorded in the Stevenson screen. A Richard thermograph, in the same screen, showed a fall from about 31°·3 at 3 p.m. on the 8th to 16°·3 at 1 a.m. on the 9th, after which there was a rapid rise to 32°·0 at 9 a.m., 44°·5 at 1·30 p.m., and a maximum of 46°·0 about 9 p.m. At 2 p.m., on the 9th, when the fall of snow had practically ceased, the depth to which it lay on level ground was 4 inches.

At Blandford, in Dorset, the minimum was 0°·9, and at Winterbourne Steepleton, near Dorchester, 12°.

A sudden frost like this is of extreme interest, showing that a very low minimum may occur in a comparatively warm month; but the moral we wish to impress is the importance of using verified instruments for every observation. Unverified instruments can never be trusted, and it is only tantalising to reflect on the chance that they may not be bearing false witness after all.

ROYAL METEOROLOGICAL SOCIETY.

THE Annual General Meeting of this Society was held at the Institution of Civil Engineers, Great George Street, Westminster, on January 16th, Dr. C. Theodore Williams, President, being in the chair.

The following gentlemen were elected Fellows:—Mr. A. J. D. Biddle, Rev. G. J. Bridges, Mr. W. A. Browne, LL.D., Miss T. H. B. Collinson, Mr. H. Cox, Mr. F. Davis, Mr. A. Deed, Mr. G. E. Ellis, Prof. C. J. W. Lowber, D.Sc., Capt. W. S. Main, Mr. G. S. Odling, Mr. F. E. Pirkis, Mr. F. Sandeman, Mr. R. W. Saul, Dr. W. H. Symons, and Mr. A. G. Thompson.

Mr. F. C. Bayard read the report of the Council for the year 1900, a year which, it stated, will long be memorable in the annals of the society, as marking the jubilee of its existence, and owing to the great loss which it sustained in the death of its distinguished Fellow, Mr. G. J. Symons, F.R.S. On February 21st, Mr. Symons resigned the Presidency, owing to illness, and the Council appointed the Treasurer and former President of the Society, Dr. C. Theodore Williams, to fill the vacant chair. The vacancy in the Treasurership was filled by the appointment of Mr. R. Inwards.

The Society's silver medal, to cadets on H.M.S. "Worcester," was awarded to Cadet R. A. Melhuish, for the best essay on "The Meteorology of the Indian Ocean."

The Council had requested Mr. Marriott to write some account of the books and pamphlets in the Symons bequest, which it was believed would give a better idea of the value of the noble bequest than a mere list of the titles of about 2,200 books and 4,000 pamphlets.

The Council reported an increase of 55 in the number of Fellows over those of the previous year; the total on December 31st being 620.

The report of the Council having been adopted, the thanks of the Society were given to the President, the Council, and the Committees for their services during the past year, and also to the Council of the Institution of Civil Engineers, for the generous permission to meet in their rooms.

Dr. C. Theodore Williams then delivered the Presidential address, on "The Climate of Norway and its Factors," for a report of which we regret that there is no space.

The following officers and Council were elected for the ensuing year:—

President, Mr. W. H. Dines, B.A.; *Vice-Presidents*, Mr. R. Bentley, F.L.S., Mr. R. Inwards, F.R.A.S., Mr. Baldwin Latham, M.Inst. C.E., and Sir Cuthbert E. Peek, Bart.; *Treasurer*, Dr. C. Theodore Williams; *Secretaries*, Mr. F. C. Bayard, LL.M., and Mr. E. Mawley, F.R.H.S.; *Foreign Secretary*, Dr. R. H. Scott, F.R.S.; *Council*, Capt. A. Carpenter, R.N., Mr. W. H. M. Christie, C.B., F.R.S., Mr. R. H. Curtis, Mr. H. N. Dickson, F.R.S.E., Mr. W. Ellis, F.R.S., Major L. Flower, Mr. C. Hawksley, M.Inst. C.E., Capt. M. W. Campbell Hepworth, F.R.A.S., Dr. H. R. Mill, F.R.S.E., Mr. W. N. Shaw, F.R.S., Mr. H. Sowerby Wallis, and Capt. D. Wilson-Barker, F.R.S.E.

REVIEWS AND BOOKS RECEIVED.

The Rosarian's Year Book for 1901, edited by the Rev. H. HONYWOOD D'OMBRAIN, B.A. London: Bemrose and Sons. 1901, 60 pp.

THIS graceful little annual, dedicated "to the rose-loving public," contains an article on Rose Weather in 1900, by Mr. Edward Mawley, divided into the seasons of Ripening, Sleeping, Awakening and Blossoming.

Report on the Rainfall in Hertfordshire in the year 1899, by JOHN HOPKINSON, F.L.S. From the "Transactions of the Hertfordshire Natural History Society," December, 1900.

THE rainfall of 45 stations is tabulated, the arrangement being according to the river-basins in which the stations lie. The whole is discussed with reference to the months of the year. As a whole the number of wet days averaged 148, less than in any of the 50 preceeding years, except 1884 and 1887.

The Weather of 1900 *at Hodsock Priory, Worksop, with Tables for the* 25 *years,* 1876 *to* 1900. By HENRY MELLISH. Privately printed, pp. 14 and table.

IN addition to a general account of the weather of the year, tables are given, showing the means and extremes of each month for temperature, and rainfall, together with monthly means of pressure, humidity, sunshine, cloud and wind, while a special table gives the annual averages for each year, from 1879 (1876 for some values) to 1900.

The International Congresses of Meteorology and Aeronautics at Paris, by A. LAWRENCE ROTCH. Reprinted from *Science*, **12** (1900), 796-799.

Meteorological Observations taken in Hertfordshire in the year 1899, by JOHN HOPKINSON. Reprinted from the *Transactions* of the Hertfordshire Natural History Society, **10** (1900), 223-232.

Annual Report of the Museums and Meteorological Observatory of the County Borough of Bolton for 1900. Bolton, 1901, pp. 16.

Meteorological Observations made at the Adelaide Observatory and other places in South Australia during the year 1897. By SIR CHARLES TODD, F.R.S. Adelaide, 1900. Folio, pp. 96 and 78. *Maps.*

Brief Sketch of the Meteorology of the Bombay Presidency for 1899-1900. Folio, pp. 18. Diagrams.

Annual Report of the Central Meteorological Observatory of Japan for the year 1898, by K. NAKAMURA. Part I., Tokio (1900). 4to, pp. 270.

METEOROLOGICAL NEWS.

THE International Meteorological Committee has issued a circular to meteorologists in all countries, requesting that all barometer readings recorded after January 1st, 1901, be corrected to normal gravity, as well as to sea-level and the freezing-point. In northern Europe this correction only affects the third place of decimals, and may be disregarded when the barometer is registered only to hundredths of an inch.

SIMULTANEOUS balloon ascents were made on January 10th for meteorological observations in the upper atmosphere at West Ham, Bath, Paris, Berlin, Strasburg, and St. Petersburg.

THE *Monthly Weather Review*, for October, 1900 (published at the end of December), contains a translation of a paper on the dynamic principle of the circulatory movements in the atmosphere, by Prof. V. Bjerknes, of Stockholm. The paper applies the methods of Kelvin and Helmholtz for the study of frictionless fluids to the particular case of the atmosphere, introducing the various necessary restrictions, and thus deducing theoretically the conditions of atmospheric circulation. The author lays down a theory, the great importance of which is that it gives a rational dynamic principle according to which the facts of observation can be grouped. The theory also applies to the movements of the ocean, and Professor Bjerknes lays stress on the value of studying oceanic and atmospheric movements as part of one great problem.

THE Report of the Meteorological Council for the year ending 31st March, 1900, has recently been published, and contains the usual reports on the work of this important public department. Considerable changes have taken place in the staff of the office since the previous Report was issued. On the death of Lieutenant Baillie, in June, 1899, the position of Marine Superintendent was filled by the appointment of Captain M. W. Campbell Hepworth, R.N.R., whose experience as a meteorological observer at sea is of long standing. When Dr. R. H. Scott retired from the office of Secretary in February, 1900, the distinguished physicist, Mr. W. N. Shaw, F.R.S., of Cambridge, was appointed his successor. The seat on the Meteorological Council thus vacated has been filled by Professor G. H. Darwin, of Cambridge. A plan providing for superannuation after long service in the Meteorological Office, has been adopted, and the scientific worker in this department is released from a disability which made the Meteorological Office less attractive than other branches of the Civil Service.

Mr. W. N. SHAW, F.R.S., Secretary of the Meteorological Council, is delivering a series of four lectures, on the "Physics of the Atmosphere," in the University of Cambridge during February.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, AUGUST, 1900.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	86·7	17	48·1	5	72·7	54·1		...	129·9	45·3	2·81	17	5·6
Malta	89·7	27	64·3	17	84·9	70·7	68·8	77	148·2	62·0	·02	1	1·3
Cape of Good Hope	70·7	2	35·1	7	62·2	47·4	48·2	77	...	...	2·76	11	4·9
Mauritius	76·4	22	54·6	10	73·6	62·3	58·2	73	141·7	45·3	1·79	12	5·5
Calcutta	93·9	25	76·4	5	89·1	78·9	78·8	87	159·0	75·0	16·28	25	8·7
Bombay	85·9	18	75·0	1	83·8	77·5	76·5	87	134·9	73·2	17·62	29	9·0
Colombo, Ceylon	89·2	25*a*	73·0	5	87·2	77·3	...	83	148·0	71·0	7·35	15	5·5
Melbourne	61·9	6	35·9	21	56·4	42·4	40·9	76	124·3	28·5	2·34	18	6·4
Adelaide	67·9	6	39·8	4	59·3	45·2	44·3	77	131·6	31·6	4·14	21	5·8
Sydney	70·1	16	40·7	21	61·0	46·4	41·3	73	119·3	30·0	·71	8	3·0
Wellington	65·0	8	37·0	30	56·1	45·8	42·1	73	110·0	29·6	4·59	18	4·9
Auckland	65·0	19	44·0	1	59·4	49·7	45·7	71	130·0	41·0	3·91	24	7·2
Jamaica, Halfway Tree	95·0	24	71·0	22	89·5	72·4	71·3	77	...	...	...	...	2·2
Trinidad	91·0	31	66·0	31	84·6	71·4	71·2	77	163·0	61·0	11·07	22	...
Grenada	88·0	31	72·0	14	84·6	74·3	70·9	71	162·8	...	7·40	25	4·4
Toronto	98·0	6	51·3	2	83·1	62·5	63·5	76	126·5	44·8	2·75	11	4·5
Fredericton New Brunswick,	92·7	26	43·5	13	74·6	54·0	53·2	62	...	...	1·78	7	5·1
Winnipeg, Manitoba	88·2	19	45·0	27	79·4	55·5	...	...	...	...	3·66	11	5·8
Victoria, British Columbia	79·0	1	44·1	26	66·3	52·4		...	...	...	·61	6	5·4

a—and 26.

REMARKS.

MALTA.—Adopted mean temp. 76°·7, or 1°·3 above average. Mean hourly velocity of wind 9·1 miles, or 1·9 above average. Mean temp. of sea 78°·6. TS on 19th, L on 17th. J. F. DOBSON.

Mauritius.—Mean temp. of air 0°·9, of dew point 1°·0, and rainfall ·65 in. below, their respective averages. Mean hourly velocity of wind 10·0 miles, or 2·4 below average; extremes, 24·5 on 18th and 1·8 on 16th, prevailing direction E.S.E. L on 30th. T. F. CLAXTON.

Adelaide.—A very cold and wet month. Mean temp. 1°·8, below average of 43 years, only one previous August colder. Rain very heavy over all central and S. districts; one of the wettest Augusts ever experienced, seven to fourteen inches fell on the mountains to E. of Adelaide. C. TODD, F.R.S.

Sydney.—Temp. 1°·2 below, humidity 8·6 below, and rainfall 2·41 in. above, their respective averages. H. C. RUSSELL, F.R.S.

Wellington.—Generally fine during early part of month, wet from 14th to 24th, with strong N.W. wind. Mean temp. 2°·9 above, and rain ·61 in. below, their respective averages. R. B. GORE.

Auckland.—A showery month, rain being registered on 24 days; but the total rainfall slightly below the average. Mean temp. 2° above the average. T. F. CHEESEMAN.

TRINIDAD.—Rain ·75 in. above the 30 years average. J. H. HART.

Rainfall at Adelaide.—The Adelaide newspapers have published a diagram showing the rainfall of that city for each year from 1839 to 1899 inclusive. The average rainfall for the 61 years is 20·84 in. The driest year was 1876 with 13·43 in., and the wettest year was 1889, when 30·87 in. fell. The rainfalls of the wettest and driest years were thus 164 and 71 per cent. of the average respectively.

SUPPLEMENTARY TABLE OF RAINFALL, JANUARY, 1901.

Div	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
I.	Uxbridge, Harefield Pk..	·92	XI.	Castle Malgwyn	3·43
II.	Dorking, Abinger Hall .	1·36	,,	Builth, Abergwesyn Vic.	6·49
,,	Birchington, BeresfordLge.	·47	,,	Rhayader, Nantgwillt ...	...
,,	Hailsham	·63	,,	Lake Vyrnwy	5·86
,,	Crowborough.....	1·16	,,	Corwen, Rhug	2·72
,,	Ryde, Thornbrough	...	,,	Criccieth, Talarvor	2·55
,,	Emsworth, Redlands ...	1·32	,,	I. of Anglesey, Lligwy..	1·36
,,	Alton, Ashdell	1·55	,,	I. of Man, Douglas	2·71
III.	Newbury, Welford Park	1·68	XII.	Stoneykirk, ArdwellHo.	2·58
,,	Oxford, Magdalen Coll..	1·00	,,	New Galloway, Glenlee	...
,,	Banbury, Bloxham	1·18	,,	Moniaive, MaxweltonHo.	3·71
,,	Northampton, Sedgebrook	·99	,,	Lilliesleaf, Riddell	1·98
,,	Huntingdon, Brampton.	·91	XIII.	N. Esk Res. [Penicuick]	2·75
,,	Wisbech, Bank House...	·73	XIV.	Glasgow, Queen's Park..	2·68
IV.	Southend	·63	XV.	Inveraray, Newtown ...	4·62
,,	Colchester, Lexden	·38	,,	Ballachulish, Ardsheal...	6·00
,,	Saffron Waldon, Newport	·55	,,	Islay, Eallabus..... ...	3·70
,,	Rendlesham Hall	·78	XVI.	Dollar.....	2·96
,,	Swaffham	·67	,,	Balquhidder, Stronvar...	5·62
V.	Salisbury, Alderbury ...	1·56	,,	Coupar Angus Station...	2·09
,,	Bishop's Cannings	1·60	,,	Blair Atholl	2·81
,,	Blandford, Whatcombe .	2·43	XVII.	Keith H.R.S.....	2·28
,,	Druid, Ashburton.....	5·21	,,	Forres H.R.S.	1·41
,,	Okehampton, Oaklands.	4·73	XVIII.	Fearn, Lower Pitkerrie..	1·59
,,	Hartland Abbey	2·47	,,	S. Uist, Askernish	2·22
,,	Lynton, Glenthorne ...	3·55	,,	Invergarry.....	4·72
,,	Probus, Lamellyn	3·69	,,	Aviemore, Alvie Manse.	2·07
,,	Wellington, The Avenue	2·79	,,	Loch Ness, Drumnadrochit	3·44
,,	North Cadbury Rectory	2·88	XIX.	Invershin	3·73
VI.	Clifton, Pembroke Road	2·07	,,	Durness.....	4·38
,,	Ross, The Graig	1·52	,,	Watten H.R.S.....	2·00
,,	Wem, Clive Vicarage ...	1·92	XX.	Dunmanway, Coolkelure	8·63
,,	Wolverhampton, Tettenhall	1·47	,,	Cork, Wellesley Terrace	5·33
,,	Cheadle, The Heath Ho.	2·16	,,	Killarney, District Asyl.	5·96
VII.	Coventry, Priory Row...	1·17	,,	Caher, Duneske	5·20
,,	Market Overton	1·12	,,	Ballingarry, Hazelfort...	2·26
,,	Grantham, Stainby	·77	,,	Limerick, Kilcornan ...	...
,,	Horncastle, Bucknall ...	·57	,,	Miltown Malbay	3·49
,,	Worksop, Hodsck Priory	1·08	XXI.	Gorey, Courtown House	3·91
VIII.	Neston, Hinderton	2·04	,,	Moynalty, Westland ...	4·30
,,	Southport, Hesketh Park	1·58	,,	Athlone, Twyford	3·35
,,	Chatburn, Middlewood.	3·65	,,	Mullingar, Belvedere ...	3·70
,,	Duddon Val., Seathwaite Vic.	5·43	XXII.	Woodlawn	3·74
IX.	Melmerby, Baldersby ...	1·52	,,	Crossmolina, Enniscoe ..	5·31
,,	Scalby, Silverdale	1·81	,,	Collooney, Markree Obs.	3·81
,,	Ingleby Greenhow Vic..	1·78	XXIII.	Enniskillen, Model Sch.	3·97
,,	Middleton, Mickleton ...	1·64	,,	Warrenpoint.....	4·94
X.	Haltwhistle, Unthank H.	...	,,	Belfast, Springfield	3·05
,,	Bamburgh	1·94	,,	Bushmills, Dundarave..	2·49
,,	Keswick, The Bank.....	...	,,	Stewartstown	3·15
XI.	Llanfrechfa Grange	3·44	,,	Killybegs	4·31
,,	Treherbert, Tyn-y-waun	6·65	,,	Horn Head	3·54
,,	Llandovery	4·17			

JANUARY, 1901.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1880-9.	Greatest Fall in 24 hours. Dpth	Date	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date	Min. Deg.	Date.	No. of Nights below 32°. In shade.	On grass.
			inches.	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	·55	— 1·16	·09	7	12	55·0	27	20·5	9	12	22
II.		Tenterden	·97	— 1·02	.20	7	16	55·0	27	20·0	8	16	22
,,		Hartley Wintney	1·26	— ·69	·16	18	18	54·0	21	5·0	9	13	17
III.		Hitchin	·78	— ·93	·19	19	15	53·0	27	21·0	8	17	...
,,		Winslow (Addington)	1·16	— ·55	·37	27	14	54·0	27	17·0	9	17	20
IV.		Bury St. Edmunds (Westley)	·70	— ·99	·19	27	10	52·0	27	14·0	9	...	...
,,		Norwich (Brundall)	·74	...	·14	25	15	53·0	27	22·0	9	16	25
V.		Winterbourne Steepleton ...	2·68	...	·53	18	21	51·9	27	12·0	9	15	19
,,		Torquay (Cary Green)	3·34	...	·81	18	21	53·5	21	22·5	9	7	...
,,		Polapit Tamar [Launceston]..	3·95	+ ·62	·93	26	21	52·3	16	15·7	9	13	16
VI.		Stroud (Upfield)	1·35	— ·86	·29	18	17	50·0	21*a*	26·0	31	16	...
,,		Church Stretton (Woolstaston)	2·14	— ·32	·36	29	15	53·0	21	22·0	9	11	29
,,		Worcester (Diglis Lock)	1·65	— ·21	·31	19	22	...	...	...	...	...	...
VII.		Boston	·57	— ·81	·21	19	5	50·0	21	21·0	9	17	...
,,		Hesley Hall [Tickhill].....	·98	— ·43	·27	19	16	53·0	21*b*	19·0	16	15	...
,,		Derby (Midland Railway).....	1·50	— ·10	·35	19	20	53·5	22	25·5	9	13	...
VIII.		Manchester (Plymouth Grove)	1·79	— ·53	·45	19	14	53·0	22	25·0	8	12	20
IX.		Wetherby (Ribston Hall) ...	2·10	+ ·44	·95	19	17	...	...	...	...	...	...
,,		Skipton (Arncliffe)	5.45	— ·93	·83	26	21	...	...	...	...	...	...
,,		Hull (Pearson Park).	·63	— 1·04	·08	25	15	53·0	22	26·0	29	18	23
X.		Newcastle (Town Moor)	1·43	— ·38	·23	7	14	...	...	...	...	...	...
,,		Borrowdale (Seathwaite).....	8·95	— 5·90	1·35	18	19	49·8	26	24·7	10	10	...
XI.	WALES.	Cardiff (Ely).....	2.30	— 1·26	·61	26	18	...	...	...	...	...	...
,,		Haverfordwest	4·83	+ ·21	1·23	18	20	51·3	27	25·3	9	6	18
,,		Aberystwith (Gogerddan) ...	2·69	— 1·56	·50	18	13	48·0	16*c*	...	...	...	...
,,		Llandudno.....	1·68	— ·85	·39	19	18	53·0	14	25·0	9	4	...
XII.	SCOTLAND.	Cargen [Dumfries]	3·52	— 1·06	·46	26	17	50·0	17*d*	26·0	6, 29	8	...
XIII.		Edinburgh (Royal Observatory)	1·83	...	·33	19	13	50·4	22	24·2	29	13	19
XIV.		Colmonell	3·29	— 1.55	·90	25	13	54·0	24	30·0	5*f*	7	...
XV.		Tighnabruaich	4.49	...	·72	26	15	45·0	20	24·0	28	13	...
,,		Mull (Quinish).....	4·49	— 1·74	·47	24	22	...	...	...	...	...	...
XVI.		Loch Leven Sluices	1·92	— 1·38	·48	27	11	...	...	...	...	...	...
,,		Dundee (Eastern Necropolis)	1·65	— ·88	·30	30	20	51·2	21	24·4	28*g*	14	...
XVII.		Braemar	3·25	+ .47	·82	25	18	48·0	21	15·6	10	19	25
,,		Aberdeen (Cranford)	2·21	— ·51	·41	29	22	53·0	21	25·0	9, 28	19	...
,,		Cawdor (Budgate)	1·87	— ·35	·46	25	13	...	...	...	...	...	...
XVIII		Strathconan [Beauly]	2·35	— 2·19	·60	10	7	...	...	...	...	...	...
,,		Glencarron Lodge.....	5·97	— 4·42	·94	21	19	57·7	14	23·6	10	11	...
XIX.		Dunrobin	2·99	+ ·37	·63	26	14	52·0	21*e*	25·8	28	11	...
,,		S. Ronaldshay (Roeberry) ...	3·51	+ ·22	·72	26	19	50.0	21	27·0	25	9	...
XX.	IRELAND.	Darrynane Abbey.....	4·33	— ·93	·97	18	24	...	...	...	...	...	...
,,		Waterford (Brook Lodge) ...	4·15	+ ·63	1·33	18	18	53·5	26	26·0	23	13	...
,,		Broadford (Hurdlestown) ...	2·98	— ·15	·65	18	23	...	...	...	...	10	...
XXI.		Carlow (Browne's Hill)	3·56	+ ·49	·67	18	18	...	...	...	...	...	...
,,		Dublin (Fitz William Square)	2·67	+ ·53	·94	9	17	53·8	22	29·1	30	3	11
XXII.		Ballinasloe	3·30	— ·14	·73	18	21	49·0	21*e*	18·0	9	19	...
,,		Clifden (Kylemore)	5·37	— 2·60	·58	12	22	...	...	...	...	...	...
XXIII		Seaforde.....	3·85	+ ·44	·43	18	18	51·0	21	22·0	23	13	15
,,		Londonderry (Creggan Res.).	3·51	— ·15	·66	26	20	...	...	...	...	...	...
,,		Omagh (Edenfel)	3·54	+ ·03	·56	11	20	51·0	22	27·0	9, 29	11	16

+ Shows that the fall was above the average ; — that it was below it.

a—and 22, 27. *b*—and 22, 26. *c*—and 17, 22, 23. *d*—and 21, 22. *e*—and 22. *f*—and 8, 9. *g*—and 29.

METEOROLOGICAL NOTES ON JANUARY, 1901.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

TENTERDEN.—A cold month and dry generally. Several inches of S fell on the 8th, mostly before 9 a.m. Windy on 19th and 20th, and in the last week with a violent WNW gale on 27th. Fog on 5 days. Sunshine 73 hours.

HARTLEY WINTNEY.—The early part was mild, but cold showers and falling temp. prevailed at the end. There was a very severe frost on the 9th, min. temp. on grass 2°·0. S occurred on 4 days, and fog on 4. Severe N.W. gale on 27th, followed by a slight fall of S. Ozone on 16 days with mean of 4·9.

WINSLOW, ADDINGTON.—From 1st to 9th there were low max. temps., particularly on 6th, 7th and 8th, with S on each day. Intense frost on 9th, followed by a great increase in the max. temp. on 10th. From the 17th to 27th the max. temp. was rather high for the season, that on 27th being 54°, when there was a heavy gale, uprooting some fine old elm trees. Dense fog on 5th, 11th and 12th. Very heavy rime all day on 5th.

BURY ST. EDMUNDS, WESTLEY.—The driest January in 44 years, except in 1880, with ·15 in. of R, and in 1889, with ·69 in. A mild month, the max. temp. being below 32° on only 2 days. T on 28th. S on 9th and 28th.

NORWICH, BRUNDALL.—R more than an inch deficient. At 3.40 p.m. on the 28th great darkness prevailed, almost like midnight, accompanied by a violent TS, lasting 20 minutes, with heavy H and S.

WINTERBOURNE STEEPLETON.—On the 4 days, 15th to 18th, 1·33 in. of R fell, which is about equal to that which fell during the other 17 rainy days of the month. The first 10 days were cold, the min. being 12° on the 9th, but a rapid thaw set in that afternoon. Although the wind was mainly from the westward the nights were colder than usual. Fog on 11th 12th and 18th.

TORQUAY, CARY GREEN.—R 1·13 in. above the average. Mean temp. 42°·3, or 0°·4 above the average. Duration of sunshine 82 hours 45 mins., being 20 hours 25 mins. above the average; six sunless days. Mean ozone 4·2; greatest 9·0 on 21st, with W. wind; least 0·5 on 15th and 24th, with E. wind.

POLAPIT TAMAR [LAUNCESTON].—Generally cold, and in the second half wet and stormy. Thick fog on 2nd and 18th; H on 26th, 28th and 30th.

CHURCH STRETTON, WOOLSTASTON.—S on 8th, and from 28th to 30th. Severe N.W. gale, lasting 48 hours, on 26th and 27th.

HULL, PEARSON PARK.—Fog on 17 days, S or sleet on 7 days.

WALES.

HAVERFORDWEST.—Cold and stormy, with very little bright sunshine, the total being 19·8 hours. A TS occurred at about 1.15 a.m. on 31st, lasting about an hour, the L was vivid, but distant; some H fell.

ABERYSTWITH, GOGERDDAN.—An open month, but with very little sunshine. A little H and S on 29th and two following days.

LLANDUDNO.—The first week was bright, the last stormy. H on 25th, 27th, 28th and 29th. T on 29th and 30th.

SCOTLAND.

CARGEN [DUMFRIES].—A dull, damp and unseasonable month. Three inches of S on 28th.

COLMONELL, CLACHANTON.—Mean temp. 39°·3, or 2°·2 above the average of 25 years. S on 8th, 25th and 27th. T and L on 25th.

TIGHNABRUAICH, CRAIGANDARAICH.—In the first half there was a high bar., with little R, but cold with E. winds; during the latter half the wind was chiefly N.E. and N., and blowing strong with S and low bar.

ABERDEEN, CRANFORD.—Free from S till 25th, after which the ground continued white.

S. RONALDSHAY, ROEBERRY.—The first 20 days were very fine, the latter part was changeable, with gales, R, S and frost. Mean temp. 38°·8, or 0°·5 above the average of 11 years.

IRELAND.

DARRYNANE ABBEY.—Except for a few fine days at the beginning, it was a wet, wild month. Gale on 27th and 28th. S on 29th and 30th, H on 30th.

BROADFORD, HURDLESTOWN.—A fairly fine month. R ·02 in. above and rainy days 1 above, the average of 16 years. Gales from S.E. on 12th, S.W. on 15th, and W. on 27th. S on 9th, 28th, 29th and 30th.

DUBLIN, FITZWILLIAM SQUARE.—An average January, as regards pressure, temp. and R. Mean temp. 41°·9, or 0°·5 above the average. Fog on 5 days; high winds on 16 days, reaching the force of a gale on 4. S or sleet on 6 days, and H on 5. The daily average of bright sunshine was 2·1 hours.

EDENFEL, OMAGH.—A mild and wet month, with mean temp. above the average, chiefly because of the absence of severe frost.

THE NEW RAINFALL AVERAGE ADOPTED IN THE GENERAL TABLE.

WHEN Mr. Symons adopted the average rainfall of the decade 1880-89, he pointed out the great importance of ensuring continuity and completeness in such a table as that on p. 14, and explained that, by using the averages of the decade just passed, it was possible to give the difference from the average at a larger number of stations than by adhering to the figures formerly employed, or by taking a 20 years' average.

It would certainly be best to adopt the average of a long period, say 50 years, but few records exist to enable such an average to be calculated, and no shorter period can be certainly relied upon as completely eliminating the effects of abnormal years, or even months. We must be content with what we can get, and, therefore, we have adopted the average rainfall of the ten years 1890-99, a period covered by the records of most of the stations in the table. The total amount of rain varies very greatly even in places which lie near together, but the relative amount of rain which falls in summer and winter does not vary so much. So, while keeping the figures for the average annual rainfall of ten years, we have found it possible to use the average monthly distribution of rainfall for a longer period. What we have done, therefore, is this: the percentage of rain which fell in each month was calculated for the period 1870-99 for 30 stations, and the average yearly fall for the decade, 1890-99, at these stations was apportioned among the different months of the year in this proportion. At the remaining stations, for which no long records existed, the mean yearly rainfall for 1890-99 was apportioned according to the monthly percentages of neighbouring stations; thus the monthly distribution at Winslow, Addington, is calculated from that at Camden Square and Geldeston.